STI®

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May 26, 1993

DOCKET FILE COPY ORIGINAL

Federal Communications Commission
Washington, DC 20554

In the matter of   )
)   Pr Docket No. 93-61
Part 90 of the Commission's Rules to   )   RM-8013
Adopt Regulation for Automatic Vehicle   )
Monitoring Systems   )

When the FCC approved the allocation of the 902 MHz, 2.4 GHz, and 5.7 GHz bands in the 1980's, dozens of companies invested millions of dollars to develop leading-edge products for industrial and commercial use in these bands. Due to the difficulty in developing Spread Spectrum products, it took time to implement and bring these products to market. Today, the enormous investment of time and money has resulted in the birth of a new industry with reliable products available from many manufacturers.

Our Company, Scientific Technologies Inc. has introduced products since the adoption of this new technology and has sold over 500 units through our nationwide distribution base of over 300 distributors. Attached please find literature describing our product. To ask our company to move current products and new development projects to another band or redesign specifications within the allocated bands affects not just our company but also our customers and their ability to utilize the products they have purchased.

Disruption within the 902 MHz band will send a clear signal to all customers and manufacturers that no investment in Spread Spectrum is safe from a rule change by the FCC. Investing in wireless technology will be adversely affected by any substantial rule change. End users, manufacturers and developers of the Part 15 technology are awaiting your ruling. Please deny the requested rule change and let our industry grow.

This industry has spawned new companies and new jobs with the potential for tremendous future growth. U.S. leadership in the wireless market promotes growth in both domestic and international markets. A change in the 902-928 MHz band could destroy all end user confidence in the wireless voice and data industry and would deal a blow to U.S. leadership in this area.

Your support in this matter would be greatly appreciated.
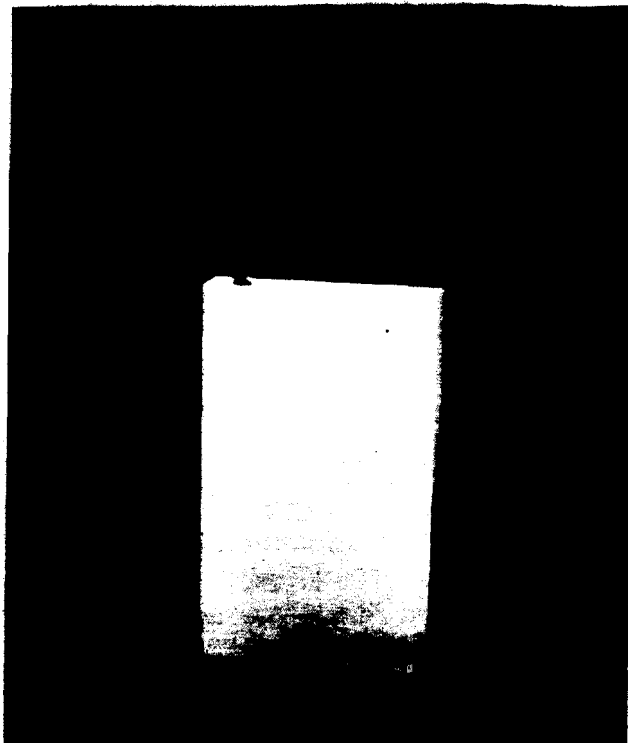
Very truly yours,

Joseph J. Lazzara
President

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List A B C D E

SPECTRADATA

FEATURES

■ Provides wireless data communications.

■ High degree of immunity to radio and electromagnetic interference.

■ Microprocessor controlled with built-in error detection.

■ Range nominally from 800 to 15,000 ft. (244 to 4,570 m) with various antennas.

■ Two-way RS-232 broadcast and point-to-point modes from 1,200 to 19,200 Baud.

■ FCC certified, no site license required.

DESCRIPTION

The STI SpectraData™ model 5500 is a spread spectrum technology, RF modem for in-plant and between-building data communications. No cables are required between modems. Unlike conventional single frequency or narrow band radio, spread spectrum transmissions use several frequencies across a broad band for superior data reliability and security.

Each SpectraData is a transceiver, that is, it is capable of both transmitting and receiving. It is also a modem that exchanges digital information between a host computer, terminal, or PLC, and controller or sensor that supports RS-232 communications.

APPLICATIONS

The SpectraData is useful anywhere wireless data communication is needed. Communication can take place between devices that use an RS-232 interface, such as computers, programmable logic controllers, automatic guided vehicles, terminals, controllers, etc. It provides wireless data communication between rooms, around corners, through walls, and between buildings. Built-in error checking ensures that data is received reliably.

SPECTRADATA

COMMUNICATION MODES

The SpectraData has three modes of communication: *broadcast* mode, *point-to-point* mode, and a *hybrid* mode which is a combination of the previous two modes.

In the *broadcast* mode, any modem will communicate with any other modem in its group that has an identical radio address, broadcast address and subchannel address. Error detection automatically assures only error-free data is accepted by the receiving modem.

In the *point-to-point* mode one transmitter communicates with only one receiver. The point-to-point mode is the preferred mode since both error detection and automatic re-try are in operation.

A third mode, *hybrid*, is a combination of broadcast and point-to-point.

• Broadcast Mode

In the following *broadcast* mode illustration, modem #0 enables a centrally located computer to communicate with different stages of an industrial process. All the modems are configured in the broadcast mode. This allows this group of modems to talk and listen to just each other without interference from other modems.

Modem #0 is configured in the *broadcast* mode with no specific destination address, and uses the radio channel and subchannel common to the process modems. Each process modem is also configured in the *broadcast* mode but each has the serial number of the computer modem #0 as its destination address. Modem #0 is the only modem to accept process modem data because all other modem transmissions include modem #0's unique serial number. Each modem will perform error detection on received data and will send only error-free data to its host digital device.
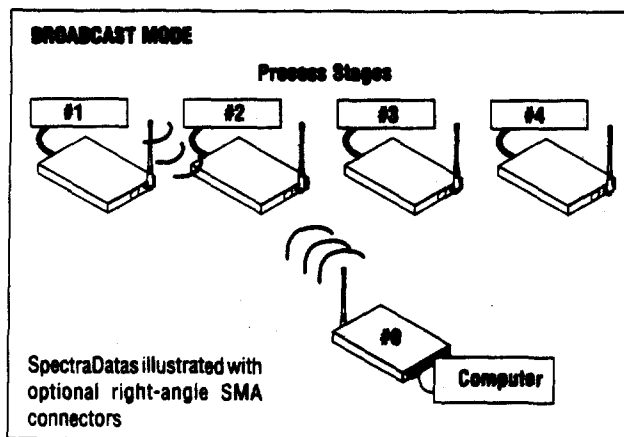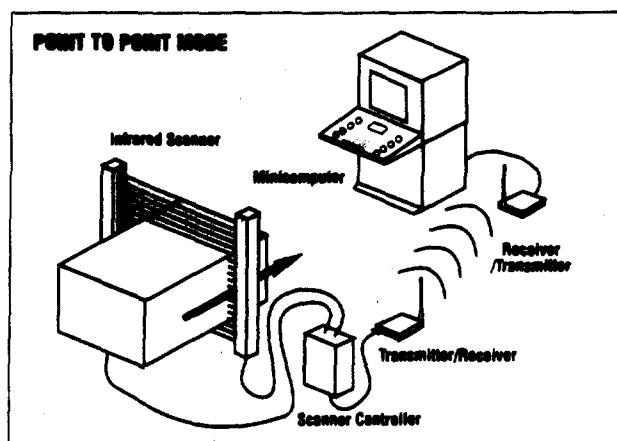
Upon command from the host computer, each process modem will begin to transfer data to its radio. When a modem is ready to transmit its data, it will *listen* to ascertain that no other modem is transmitting, then it will transmit. If another modem is *heard*, it will keep listening for an opportunity to transmit. This technique is called *collision avoidance*. In the *broadcast* mode, only the error detection algorithm is used. The automatic re-try feature is disabled, since the *identity* for the transmitter unit is unknown to the receiver in the *broadcast* mode.

The SpectraData is shipped from STI *preset* to the *broadcast* mode: radio channel 3, subchannel 1, broadcast channel 1, 9600 Baud, 1 start bit, 8 data bits, 1 stop bit, no parity bit, no echo and no flow control. During power off this preset configuration is retained in EEPROM (electronically erasable, programmable, read only memory). Therefore, when powered up again, the SpectraData will begin communicating within one second as it was *preset*.

• Point-to-point mode

In the illustration below, an industrial computer and large-object scanner are in separate locations. The computer's modem and the scanner's modem are both configured in the *point-to-point* mode, each with the other's specific radio address. This allows them to talk and listen only to each other, even in the presence of other SpectraData modems operating on the same channel.

POINT TO POINT MODE

BROADCAST MODE

Process Stages

SpectraDatas illustrated with optional right-angle SMA connectors

The modem may also be configured for *receive only*, a necessary feature in some applications. Both error detection and re-tries are active in *point-to-point* operation. If received data does not pass the error detecting algorithm, an *acknowledgment* is not sent to the transmitting modem. Without an acknowledgment, the transmitting modem will re-try the transmission up to 64 times, then *halt* further transmissions or *continue* with new data transmissions, depending upon how the modem was configured. In any case, the receiving modem will not pass faulty data to its host digital device.

SET-UP CONFIGURATION

Although STI ships the SpectraData in *broadcast* mode as the *preset* configuration, this may not be appropriate for a particular application. To change the configuration requires a terminal or a PC equipped with any popular terminal-emulating software running at 9600 Baud, 1 start bit, 8 data bits, 1 stop bit, no parity bit and no flow control.

After attaching the terminal or PC to the Spectra-Data via an RS-232 cable, depress the modem push button and the following main menu will be displayed as the modem enters its *user interface* mode:

USER INTERFACE MODE SCREEN:

The operator chooses the appropriate communication parameters from the keyboard and then launches the *operating* mode. Once set-up, the user need not re-configure the modem because settings are stored in its non-volatile EEPROM. For logical as well as visual identification, each modem has a unique serial number embedded in its firmware (unalterable program) that is also printed on its label on the bottom of the unit.

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            SpectraData 5500 V2.3
                   By STI

                  MAIN MENU

   Serial # 31095          Radio Channel: 3

   D - Display Modem Parameters
   R - Reset Parameters to Defaults
   C - Change Radio Channel
   N - Network Configuration
   S - Serial Port Configuration
   A - Advanced Configuration
   L - Launch Operating Mode

   Enter Selection:
```

A remote unit in the *broadcast* mode can be remotely switched through another modem from *broadcast* to *point-to-point* but not conversely.

SPECTRADATA

RADIO COMMUNICATIONS

Each SpectraData 5500 is both transmitter and receiver, thereby supporting two-way operation. There are a total of seven overlapping channels in the 902 to 928 MHz frequency band that is authorized by the Federal Communications Commission (FCC) in the USA. Corresponding agencies in Australia, Canada and Mexico have
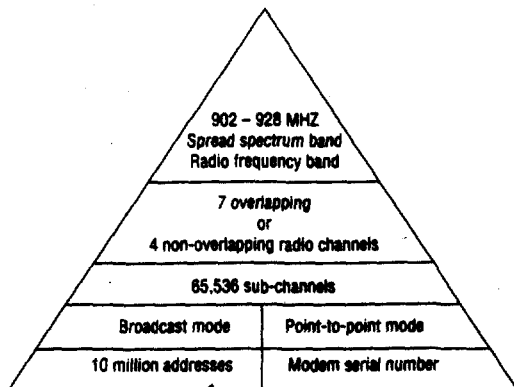
also authorized this frequency band for spread spectrum radios.

If multiple systems within reception range are to operate on different channels, non-overlapping channels should be used – four are available. A single communication channel occupies approximately 3.6 MHz. The transmitted data is *spread* redundantly by *direct sequencing* over the channel in a defined manner. This greatly in-

creases resistance to interference. The corresponding receiver *de-spreads* the redundant RF signals to recover the data. The SpectraData executes its error checking algorithm to verify data integrity and passes only good data over the RS-232 channel to its host device.

| APPLICABLE SETTINGS	
Baud Rate:	1.2K, 2.4K, 4.8K, 9.6K, 19.2K.
Echo:	None; Simple; Terminal
Flow Control:	XON/OFF Generation; XON/OFF Recognition; CTS Generation; DSR Recognition
Maximum (Line Length):	1 to 576
Input Time-out (1/16 sec):	1 to 16
Add or remove up to 4 delimiters:	ASCII characters 1 to 255

SERIAL COMMUNICATION
APPLICABLE SERIAL PORT PARAMETERS

The SpectraData is provided with an RS-232 port, terminated on a female DB-9 connector. The RF modem conforms to Data Communications Equipment (DCE) standards, while the user's device must adhere to Data Terminal Equipment (DTE) standards. The pin-outs and cable connections are shown below:

APPLICABLE RADIO PARAMETERS

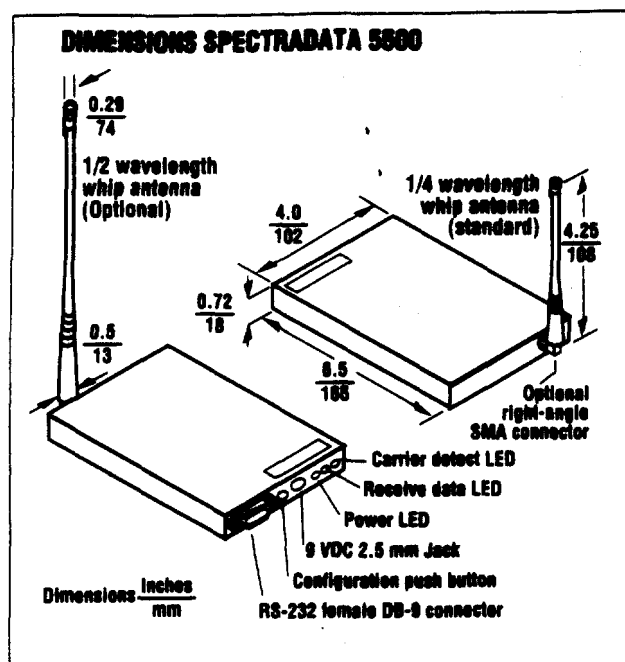| RADIO PARAMETER	APPLICABLE SETTINGS			
	BROADCAST MODE		POINT-TO-POINT MODE	
	TRANSMIT	RECEIVE	TRANSMIT	RECEIVE
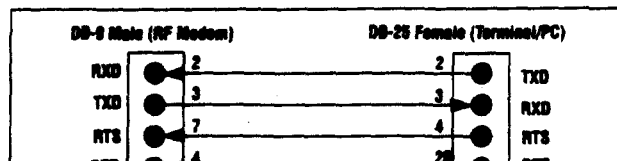
If hardware *flow control* is disabled, the modem will function with only three wires: 2, 3 and 7. Spectra-Data will also support 7 bits with parity, treating parity as the 8th bit. Nine-bit data, employed by some micro-controllers, is not supported by SpectraData.

The modem does not generate, filter or interpret any data. Only the user device data appears at the corresponding receiver RS-232 port. The only exception is for *flow control*. In this case, the modem intercepts and generates the XON

the red PWR indicator on the transmitter modem will pulse single flashes, presuming the *lost communication* parameter was set to *Halt* when the modem was last configured. If the last configuration was set to *continue*, the next data packet will be sent.

Automatic re-tries are not enabled during *broadcast* mode because *acknowledged signals* are not sent by modems configured for the broadcast mode. However, the CRC-16 error detection algorithm will still function, thereby

DIMENSIONS SPECTRADATA 5560

Dimensions $\frac{\text{inches}}{\text{mm}}$

Labels in diagram:
- 1/2 wavelength whip antenna (Optional)
- 1/4 wavelength whip antenna (standard)
- Optional right-angle SMA connector
- Carrier detect LED
- Receive data LED
- Power LED
- 9 VDC 2.5 mm jack
- Configuration push button
- RS-232 female DB-9 connector

SPECIFICATIONS

Size:	4.0 x 6.5 x 0.75 in. (10.2x16.5x1.9 cm)
Enclosure:	Aluminum
Weight:	≤12 oz. (349 grams)
Standard Antenna:	4in. (10 cm)quarter wave, 0 dB gain whip.
Antenna Options:	8 in. (20 cm) half-wave, 2.5 dB gain whip.
	105° cone 6 dB gain directional Yagi.
External LEDs:	Power, carrier detect, receive data
Recessed Push-Button:	Configure mode activation.
RS-232 Connector:	DB-9 female on panel
DC Power Connector:	2.5 mm DC male power jack on panel.
	Center pin is negative.
Temperature:	–20° to 60° C operating,
	–50° to 85° C storage.
Relative Humidity:	20% to 90% (non-condensing).
Input Power:	9 VDC regulated to ±0.2V (<.5 V ripple)
	Transmit: 0.325 Amp
	Receive: 0.175 Amp
Output Power:	500 milliwatt transmitter
Nominal Range Inside Building:	800 ft.(244 m), varies with building
(with standard quarter-wave	construction and other obstructions.
whip antenna)	Longer ranges with optional antennas.
Frequency Band:	902-928 MHz (spread spectrum)
Total no. of overlapping channels:	7 (#1 through #7), 3.6 MHz wide.
Non-overlapping channels:	4 (#1, #3, #5 & #7), 3.6 MHz wide.
Sensitivity:	–90 dB minimum

Adjacent Channels:	–55 dB
Noise Immunity:	> +60 dB
Processing Gain:	> +10 db $(10 \log \frac{\text{Radio bandwidth}}{\text{Data bandwidth}})$
Data Rates:	1.2 to 19.2 K Baud
Data Format:	8 data, 1 start , 1 stop, no parity bits
Control Lines:	TXD, RXD, RTS, CTS, DSR, DTR at
	RS-232 levels.
Echo Mode:	Simple, terminal or none
Data Communication Control:	Line lengths, delimiters, and input
	time-outs
Line Length:	1 to 576 characters
Number of Delimiters:	4 max.
Input Time-Outs:	0 or 1/16 to 16/16 second.
Flow Control:	X ON/X OFF, generates CTS and DSR
Message Destination:	Specified modem or broadcast.
Serial # Filter:	Accept message from any modem or
	from a specified modem only.
Type Filter:	Accept broadcast only, directed only, or all.
Medium Access Control (MAC):	CSMA/CA
Logic Link Control (LLC):	Point-to-point acknowledged or broadcast.
Physical Address:	32 bits
Error Detection:	CRC-16
Licensing:	No site license required. Certified under
	Part 15 of United States Federal
	Communications Commission regulations.

SPECTRADATA

RADIO ... NA

RANGE AND ANTENNAS

The effective range between the SpectraData transmitter and receiver depends upon the intervening obstacles and the type of antennas used.

Indoor obstacles include, walls, floors, ceilings, furniture, machinery, etc. Outdoor obstacles include, buildings and their contents, machinery, automobiles, trees, hills, etc. All of these and other obstacles absorb, shield, deflect, and in some cases, re-transmit SpectraData RF energy.

The SpectraData is shipped with a 1/4 wavelength antenna, the ANT-1, as its standard antenna. For greater range or the ability to overcome the effects of obstacles, two optional antennas are offered: the ANT-2 and ANT-3.

	SPECTRADATA equipped with ANT-1	SPECTRADATA equipped with ANT-2	SPECTRADATA equipped with ANT-3
Nominal Range	800 Ft. 244 m	1,600 Ft. 488 m	15,000 Ft. 4,570 m

DATA CABLE

The SpectraData attaches to the user's data device by means of an RS-232 cable. STI offers an optional serial cable model SC-55 that is 6 ft. (1.8 m) long, has a male DB-9 connector on one end and a female DB-25 on the other. This cable supports either a terminal or personal computer serial port. A DB-25 gender changer may be required for some terminals.

POWER REQUIREMENTS

Each SpectraData 5500 requires external regulated power of 9 VDC @ 0.4 Amps with not more than 0.5 Volts of ripple. An optional wall-mounted power supply, model PS-55, is available from STI. the purchase of this model is strongly recommended for proper operation of the SpectraData.

In normal operation the 5500 draws 175 mA in the receive mode or 325 mA in the transmit mode. Reasserting RTS returns the unit to either the receiver or

ORDERING INFORMATION

For in-building use where the maximum range required is not greater than 800 ft. (245 m), the following items for each modem location are suggested:

Model	Part No.	Description
5500	42452	Basic mode, includes 4 in. (10 cm) 0 dB gain whip antenna
PS-55	42466	Power Supply, 120 VAC wall mount, with 6 ft. (1.8 m) cable and 2.5 mm barrel connector for 9 VDC output.
SC-55	60162	Serial Cable, 6 ft. (1.8 m) long with Male DB9 and Female DB25 connectors for attaching the modem to a PC.

If longer ranges are required, select ANT-2 or ANT-3 from the accessories.

ACCESSORIES

| Model	Part No.	Description
PS-55	42466	Wall mount power supply
SC-55	60162	6 ft. (1.8 m) serial cable
RAC-55	42473	Right-angle SMA connector orients whip antenna at right-angle to top surface of 5500.
ANT-1	42456	4 in. (10 cm) 0 dB gain antenna (spare). Provides nominal, omni-directional range up to 800 ft. (244 m).
ANT-2	42457	8 in. (20 cm) 2.5 dB gain whip antenna attaches directly to the modem. Provides nominal, omni-directional range up to 1,600 ft. (488 m).
ANT-3	42458	4 element Yagi type 6 dB gain antenna with U-bolt. Provides nominal uni-directional range up to 15,000 ft. (4,570 m). Requires customer-provided mast for mounting and cable kit for attaching to the modem.
CK-55	42465	Cable kit consisting of a 20 ft. (6.1 m) 50 Ohm coaxial cable with Female SMA connector on one end. User cuts cable to proper length and crimps N-type RF connector provided.

Specifications are subject to change without notice.

5500
STI MODEL NUMBER

APPLICATION	WIRELESS DATA COMMUNICATION
CONFIGURATION	RADIO FREQUENCY
RANGE	800 FT (244 M) TO 15,000 FT (4,572 M)
TEMP	–4°F to +140°F (–20°C to +60°C)
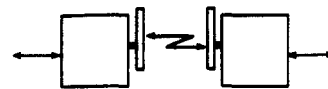
WARRANTY

Scientific Technologies, Inc., STI, warrants its products to be free from defects of material and workmanship for one year from date of purchase. STI will, without charge, replace or repair any equipment found defective upon inspection at its factory provided the equipment has been returned. TRANSPORTATION PREPAID, within one year from the date of purchase. This express warranty is in lieu of and excludes all other warranties, guarantees, or representation, expressed or implied. There are no implied warranties of merchantability or of fitness for a particular purpose. In no event shall STI be liable for consequential damages, or for expense occasioned by the use of defective parts. This warranty is void if the product has been modified or subjected to misuse or abuse. In no case shall STI's liability under any other remedy prescribed by law exceed the purchase price.

PATENT STATEMENT

Elements of the electronics essential to meet the specifications and performance standards of STI controls are covered by one or more U.S. patents and other patents pending.